FLEXOR TENDON LATE RECONSTRUCTION (INCLUDING TENOLYSIS)

BIG HAND EVENT 2023

Friday, 22 September 2023

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SECONDARY TENDON SURGERY

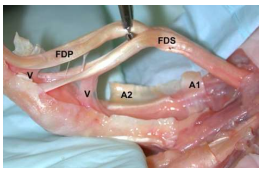
DIFFICULT SURGERY

NOT FOR NOVICE HAND SURGEON

«OPEN MIND and EXPERIENCE» TO **CHANGE OF PROGRAM DURING THE SURGERY**

UNESPECTED EVENTS

RESULTS NOT GOOD LIKE IN PRIMARY REPAIR



SECONDARY TENDON SURGERY

FLEXOR TENOLYSIS if PROM > then AROM

PULLEY RECONSTRUCTION

FLEXOR TENDON GRAFT
- ONE STAGE
- TWO TIMES

FLEXOR TENOLYISIS

PREREQUISITES

PROM > then AROM
INTACT TENDON !
FULL/GOOD PROM - (SUPPLE JOINTS)
HEALED BONE FRACTURES
GOOD SKIN COVER
MUSCLE GOOD POWER
FREE MOUVEMENT ANTAGONISTS
MOTIVATED PATIENTS – NO COMORBOLITYES

FLEXOR TENOLYISIS

OTHER IMPORTAT FACTORS …. TO DECIDE

AGE
OCCUPATIONAL NEEDS
PATIENT PREFERENCE
SENSATION
VASCULAR INJURY
JOINT STIFFNESS (ARTROLISIS?)

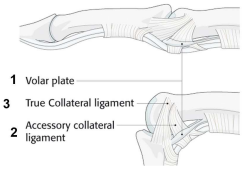
NO PREVIOS TENDON SURGERY - BETTER !

FLEXOR TENOLYISIS

JOINT STIFFNESS
EXTENSOR ADHESIONS

CONSIDER ARTHROLYSIS or EXTENSOR TENOLYSIS as A FIRST STEP PROCEDURE before

VOLARARTROLYSIS - 3 STAGES IPP



CONSIDER FUSION IF THE POSSIBILITY OF SUCCESS IS LOW !!!

ARTICULAR AND TENDINEOUS STIFFNESS

(flexors and extensors)

GLOBAL CONTRACTURE

ONE STAGE ?

TWO SATGES ?

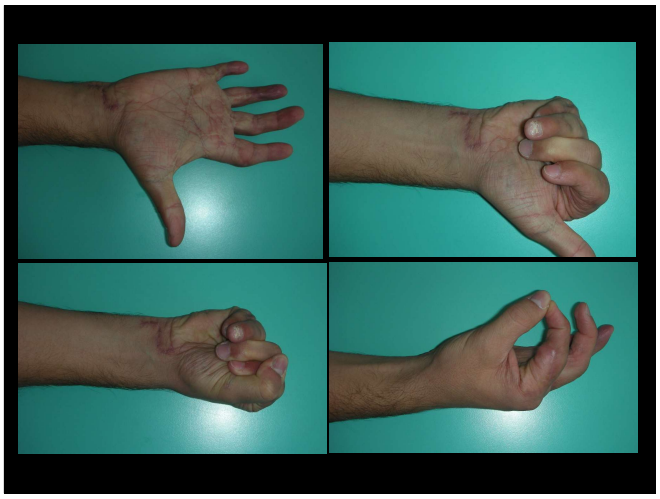
IF GLOBAL CONTRACTURE

STAGED POROCEDURE

1 **ARTROLYSIS IPP or MP and EXTENSORS TENOLYSIS**

2 **FLEXOR TENOLISIS if JOINT ARE SUPPLE**

if passive ROM is achieved



TIMING

IF PREVIOUS SUTURE OF TENDONS

NO BEFORE 3 MONTHS – SUGGESTED 3 to 6 monts

(there is a limit of time ????)

IF PREVIOUS TENDON GRAFT

NOT BEFORE 6 MONTS

IF ADESION AFTER A FRACTURE

… after the fracture healing ….. no specific timing or maximum timing is suggested

DIAGNOSTIC ASSESSMENT

XRAYS:

Rule out degenerative changes of stiff joints

Any bone condition to be corrected

MRI:

If doubt about rupture

Level of proximal stump

Partial rupture

Lengthening of tendinous callus

Ultrasound:

Tendon assessment:

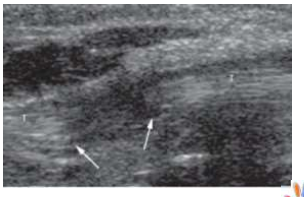
Rupture or adhesions ?

Retraction ?

Synovitis ?

Level of adhesion

Dynamic assessment: gliding ?



ANESTESIA

LOCAL **BLOCK**

ADVANTAGES

- INTAOPERATIVE EVALUATION
- WALANT – no turniquet
- NO SEDATION
- IMMEDIATE PATIENT EDUCATION
- USEEFUL FOR DIFFICULT AND NOT PREVEDIBLE PROCEDURES
- POSSIBLE TO CHANGE PROCEDURE EASYLY
- COMPLEX TENOLYSIS – NERVE RECONSTRUCTION, etc

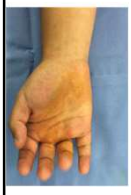
DISADVANTAGES

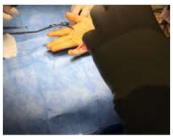
- SURGICAL FIELD – NOT BLODLESS
- DIFFICULT TO CHANGE PROCEDURE
- NO ACTIVE MOVEMENT

ANESTESIA

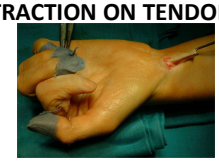
LOCAL **BLOCK**

INTRAOP MOVEMENT





TRACTION ON TENDONS



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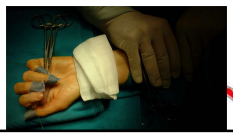
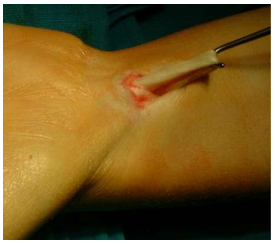


TIP AND TRIKS

NEVER STRETCH TOO MUCH THE MUSCLE BELLY …. POSTOP WEEKENING



UNEXPECTED EVENTS

PATIENT INFORMATION

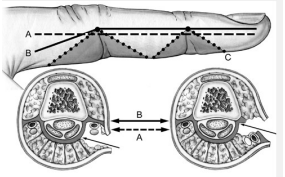
LOCALAZIED OR *WIDESPREAD* ADESIONS TO BONE OR TO PULLEY … OR BOTH

EXPOSURE CAN CHANGE DURING SURGERY

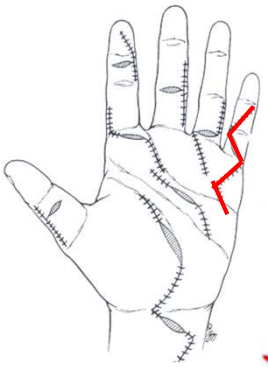
PATIENT SHOULD ACCEPT ALL **UNEXPECTED EVENTS** AND **PROGRAM CHAINGING** (pulley reconstruction, tendon rupture, graft, staged tendon reconstruction, removal of a part/total tendon FS, immediate tendon transfers)

INCISIONS

ALLEN TEST !



MIDLATERAL

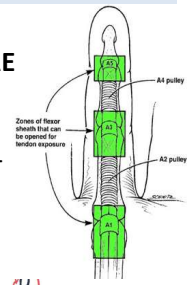


SPEZZATE

TECHNIQUE

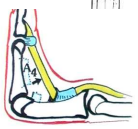
IDENTIFY WHERE THE ADESIONS ARE

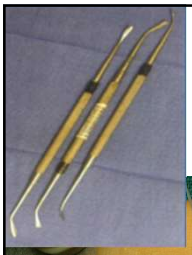
ANULAR PULLY SHOULD BE RESPECTED AS MUCH AS POSSIBLE – TRANSVERSE INCISIONS in the CRUCIATE PULLEY or (A1,A3, A5)



DIVIDE ADESIONS PROGRESSIVELY

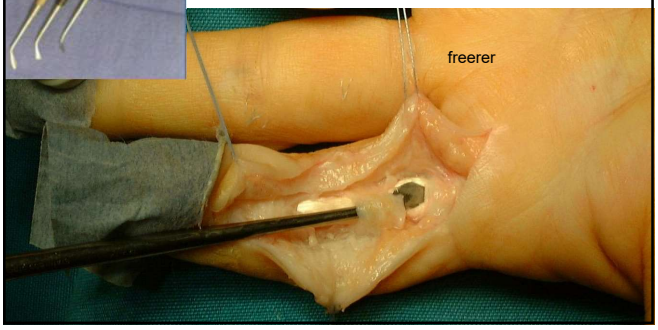
A2 and A4 – do not TOUCH !

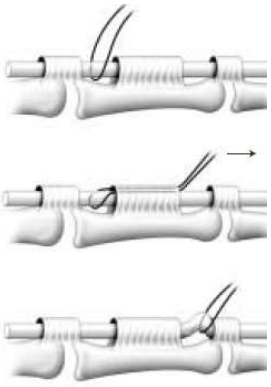




MEALS' TENOLYS KNIVES or FRIER
blunt tissue plane seeker

MONOFILAMNT SUTURE
STEVENS SHISSORS



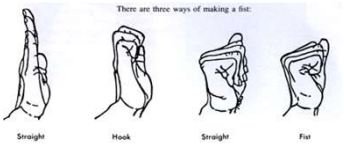


ZONE II
possible removal of superficialis

REHABILITATION

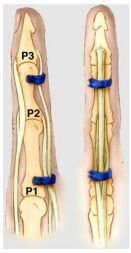
IMMEDIATE HAND THERAPIST

3 days postop – Active movement preceded by passive worming (as for flexors after repair)



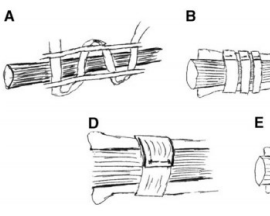
PULLEY RECONSTRUCTION

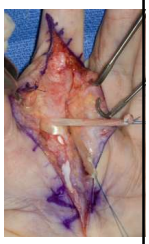
A2 and A4 are the two most important pulley



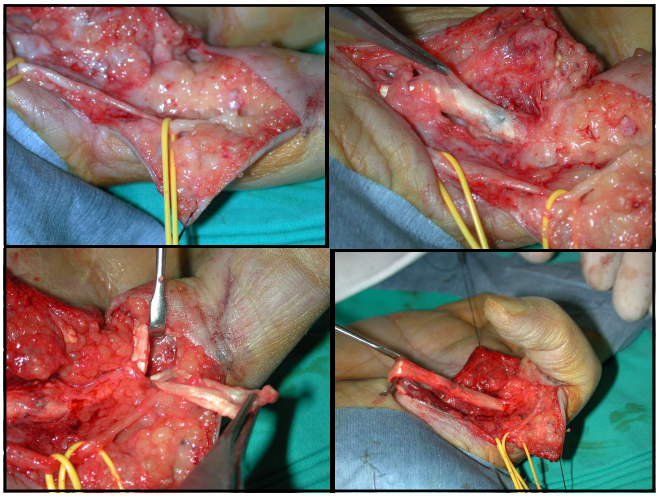
TENDONS
PALMARIS, FDS, EDM, TOE EXTENSORS, PLANTARIS

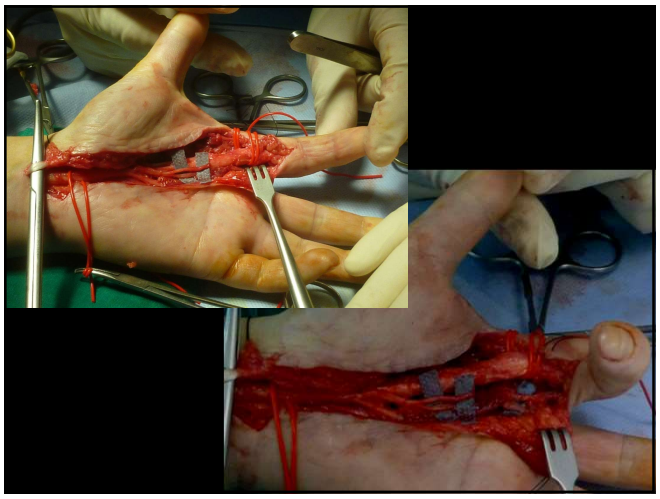
EXTENSOR RETINACULUM

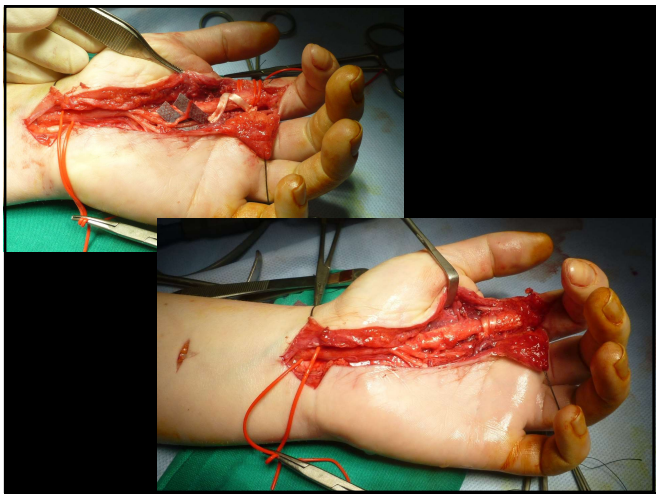


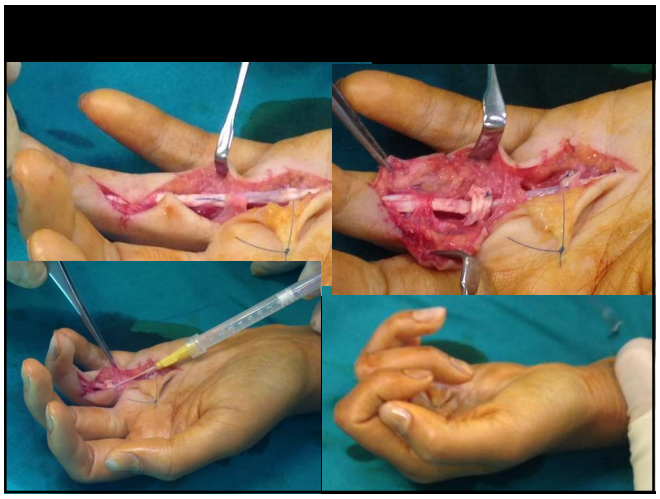


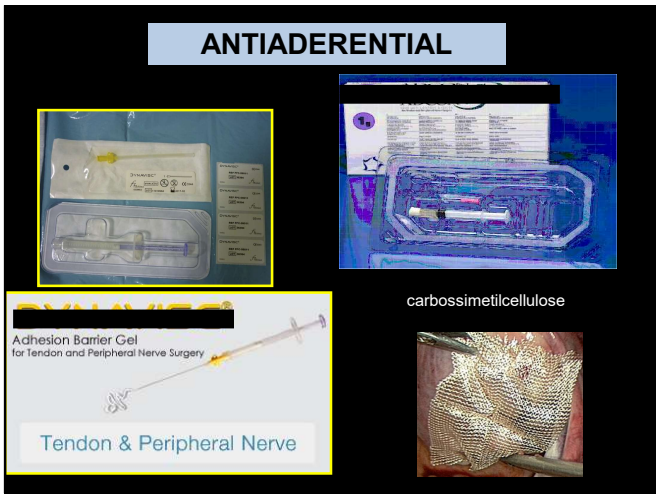
(A) The Kleinert/Weilby
(B) The triple loop forms a wide pulley reconstruction by individually passing three tendon grafts around the phalanx.
(C) The Karev technique involves making two transverse incisions in the volar plate and sliding the tendon through the so called "belt-loop" that is formed.
(D) Lister's technique wraps a segment of extensor retinaculum around the phalanx.
(E) The loop and a half technique passes a tendon graft around the phalanx and then through the substance of one limb of the tendon graft

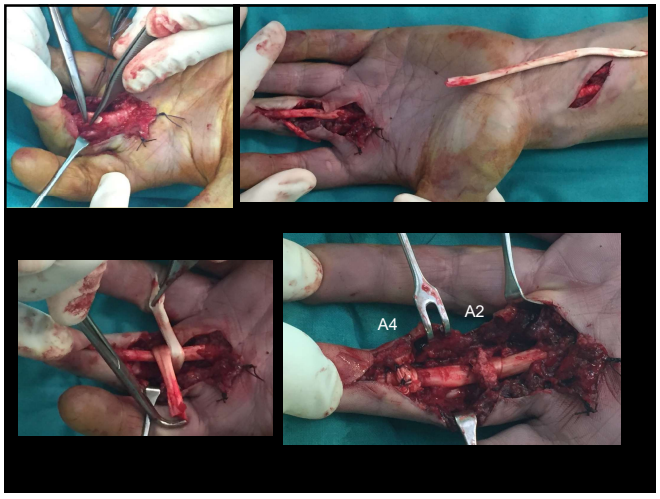












COMPLICATIONS

SECONDARY RUPTURES
5% in tendon repaired/grafted

NEW ADESIONS

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FLEXOR TENDON GRAFTING

ONE STAGE

RARE

TWO STAGE

SILICON ROD

TENDON GRAFT

PREREQUISITES

FULL PROM
STABLE SOFT TISSUE
HIGLY MOTIVATEDE AND YOUNG PATIENT
INTACT NEUROMUSCULAR STATUS

INDICATIONS

- **IRREPARABLE DELAYED presentation of FLEXOR TENDON LACERATION in the finger**
- **FAILURE OF PREVIOUS FLEXOR TENDON REPAIR**
- **FLEXOR TENDON RUPTURE AFTER TENOLYSIS**
- **Excessive scarring of the tendon bed with INCOMPETENT PULLEY SYSTEM**

RELATIVE CONTRAINDICATIONS

- Flexor Superficialis INTACT – think to IPD Fusion
- History of non-compliance
- History of infection
- Neurovascular impairment

CONTRAINDICATIONS

- **Poor passive ROM**

AFTER 30 ? …. DAYS of tendon laceration or later

TENDON GRAFT

PALMARIS LONGUS
PLANTARIS LONGUS
LONG TOE EXTENSORS
TOE FLEXORS

TENDON TRANSFER

PARTIAL FLEXOR LONGUS

PARTIAL/TOTAL FLEXORIS SUPERFICIALIS

If ruptures occur soon after primary repair, direct resuture of the ruptured tendons may be attempted; or immediate tendon graft;
if ruptures occur at the late period and no pulley are present a secondary tendon graft is indicated

DIGITAL TENDON SHEATH CONDITION ??

If **good condition** and a suitable proximal motor tendon can be identified, is possible to **proceed with single-stage tendon graft/transfer reconstruction**

1 STAGE

if
severely damaged or contracted
two stage tendon graft reconstruction

2 STAGE

INDICATIONS
Tendon graft as a first stage

NOT COMMONLY DONE !
INDICATION ARE CONTROVERSIAL

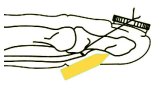
MINIMAL SCAR

PRESENCE OF NON CONTRACTED PULLEY

GOOD SKIN

ADEGUATE VASCULARITY

GOOD PROM

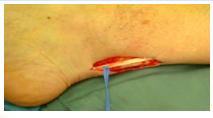


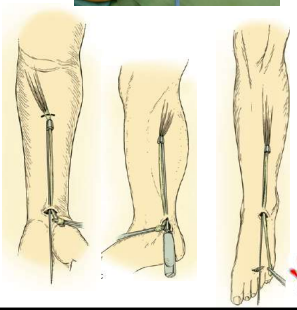
GRAFT

PALMARIS LONGUS (absent in 15% of population)
most common

PLANTARIS (absent in 10-20%)
indicated if longer graft is needed

LONG TOE EXTENSOR (IVth or IIIrd)

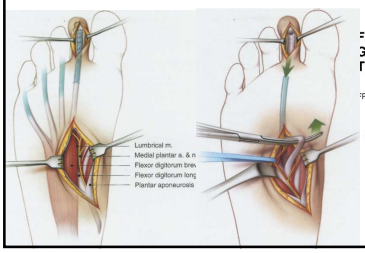




GRAFT

Toe flexor grafts.

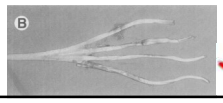
Multiple digits can be grafted using **toe flexors**, as illustrated by this case.



FLEXOR DIGITORUM PROFUNDUS TENDON GRAFTING (INTRASYNOVIAL DONOR TENDONS)

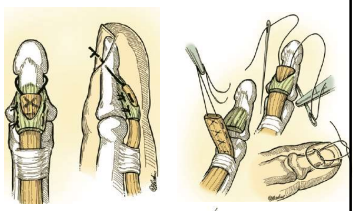
FRASER J. LEVERSEDGE, MD and JOHN G. SEILER III, MD

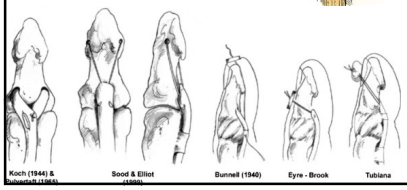
Operative Techniques in Orthopaedics, Vol 8, No 2 (April), 1998: pp 106-

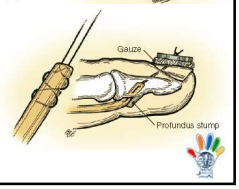


PLACEMENT OF THE GRAFT DISTAL – FIRST

- **METALLIC SUTURE ANCHOR** METHOD AND THE USE OF A NONABSORBABLE SUTURE - METALLIC ANCHORS –
- **PULL-OUT SUTURE**
- **TANG 8 STRAND suture**







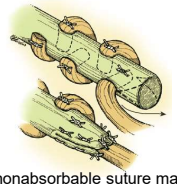
PLACEMENT OF THE GRAFT PROXIMAL

AN END-TO-SIDE PROXIMAL TRANSFER IF BOTH PROXIMAL MOTORS ARE UNSUITABLE

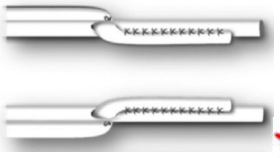
PULVERTAFT

FRIEDEN

ON FEXOR PROFUNDUS OF THE DIGIT OR NEIGBORB DIGIT



3-0 nonabsorbable suture material



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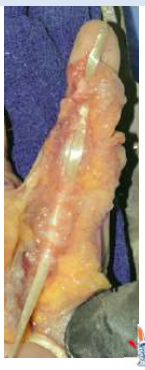
PLACEMENT OF THE GRAFT PROXIMAL

The **intact proximal FDP** tendon is preferred as the graft "motor,"

FDP tendon of an uninjured neighboring digit may be used as an end-to-side proximal transfer if both proximal motors are unsuitable.



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HEMI-TENDON TRANSFER
IN ONE ot TWO STAGE TENDON GRAFTING

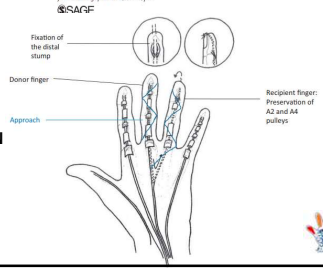
J Hand Surg Eur Vol. 2018 Jun;43(5):487-493.

Full Length Article

JHS(E)

Results of heterodigital flexor digitorum profundus hemi-tendon transfer for 23 flexor tendon injuries in zones 1 or 2

Aude Bommier[1], Duncan McGuire[2], Patrick Boyer[1], Asan Rafee[3], Sami Razali[4] and Christophe Oberlin[5]



HETERODIGITAL FLEXOR TENDON

HALF FDP TENDON

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HEMI-TENDON TRANSFER
IN ONE ot TWO STAGE TENDON GRAFTING

TENDON TRANSFER VS TENON GRAFT

ADVANTAGES	DISADVANTAGE
AVOID A PROXIMAL TENDON SUTURE	NON INDIPENDENT MOVEMENT
LESS COMPLICATION	

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TWO STAGE TENDON GRAFTING

HUNTER
J Bone Joint Surg Am. 1971

1st step : **Silicon rod and pulley reconstruction**

2nd step : **tendon graft**

(PL, PL, Extensor foot)

PANEVA - HOLEVIC
J Bone Joint Surg Am. 1969

1st step : the cut ends of the tendons of the superficial and **deep flexors of the respective finger are sutured to one another** at the lumbrical muscle level - silicon rod /pulley reconstruction

2nd Step : The pedicle is then reversed, and its end is fixed to the distal phalanx.

FDS tendon was employed as a pedicled graft to be utilized at the second stage, eliminating the need to harvest a graft.

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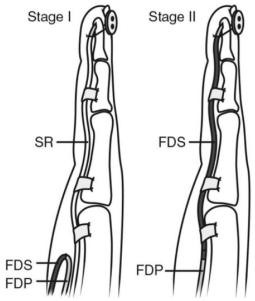
TWO STAGE TENDON GRAFTING



PANEVA - HOLEVIC
J Bone Joint Surg Am. 1969

ADVANTAGES ADVOCATED

FDS graft is intrasynovial (fewer adhesions than extrasynovial grafts)

only relying on 1 tenorrhaphy site (distal or proximal) **to heal at any one time** (vs Hunter technique where 2 tennoprhaphy sites are healing simultaneously)

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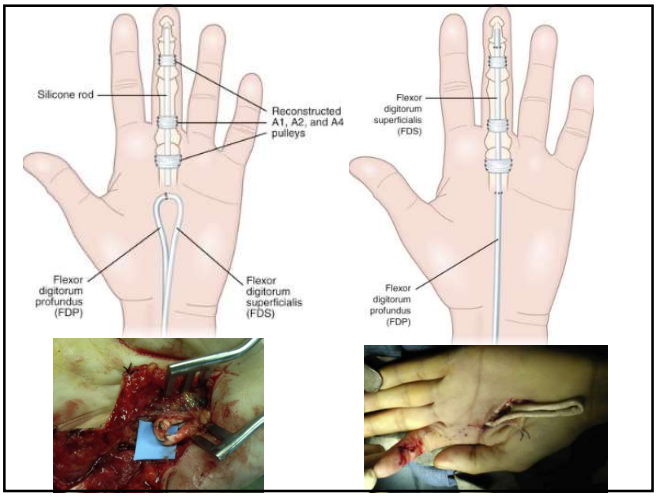
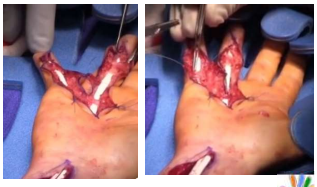


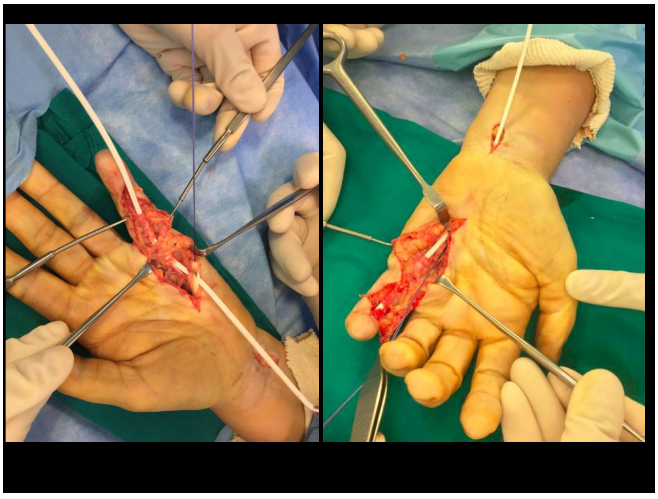
TWO STAGE TENDON GRAFTING

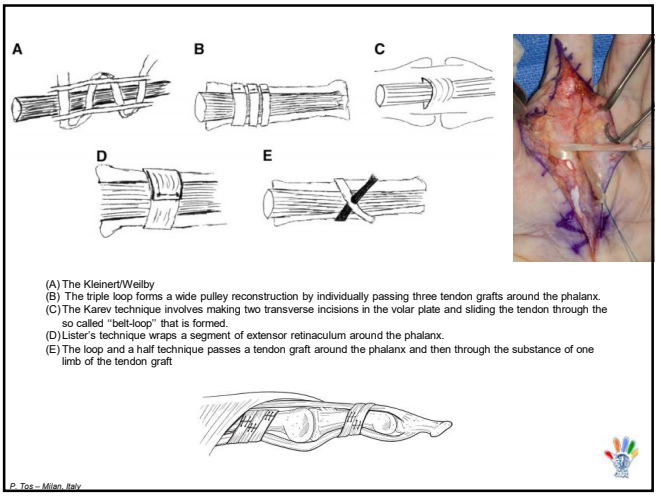
HUNTER TECHNIQUE

- **STAGE I**
- Excise tendons
- Pulley reconstruction
- Silicon rod insertion and **secured distally**
  - silicon rod
  - silicon catheter
- Eventual **artrolysis**



P. Tos – Milan, Italy





(A) The Kleinert/Weilby
(B) The triple loop forms a wide pulley reconstruction by individually passing three tendon grafts around the phalanx.
(C) The Karev technique involves making two transverse incisions in the volar plate and sliding the tendon through the so called "belt-loop" that is formed.
(D) Lister's technique wraps a segment of extensor retinaculum around the phalanx.
(E) The loop and a half technique passes a tendon graft around the phalanx and then through the substance of one limb of the tendon graft

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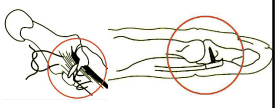
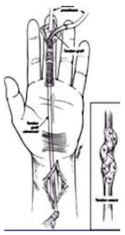
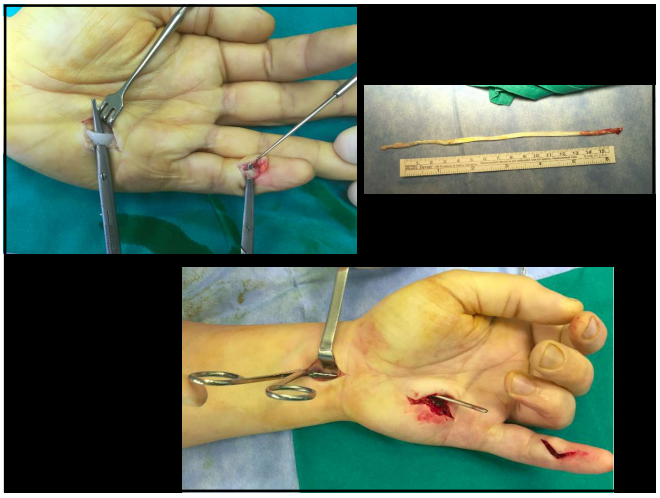
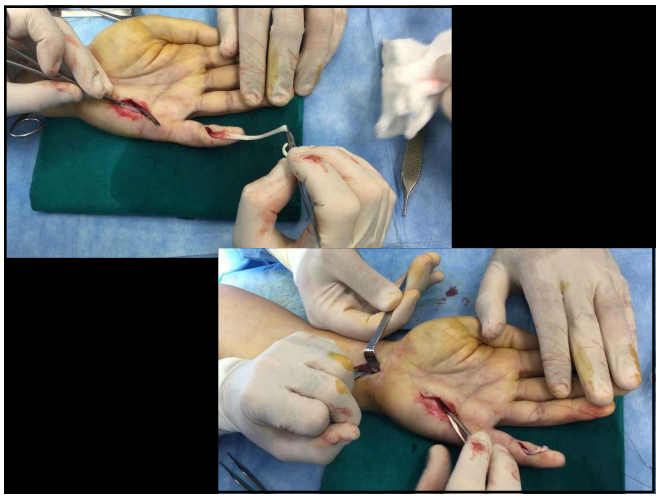
TWO STAGE TENDON GRAFTING

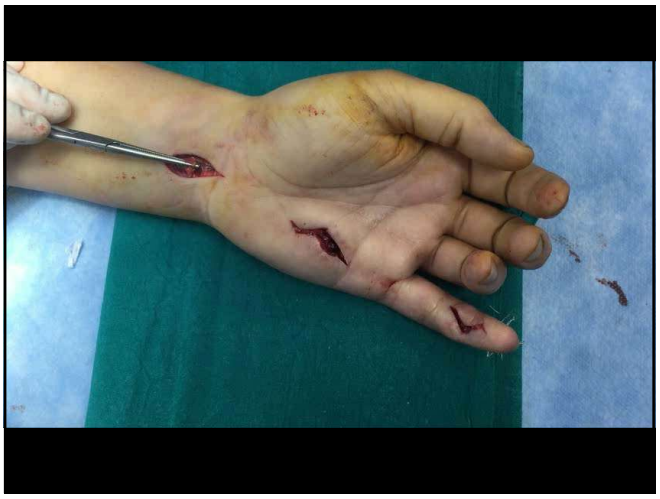
- **STAGE 2 – 3 months later**
- Release distal end of rod
- Attach graft to proximal end of rod and pull graft distally
- Attach the graft to the distal falanx
- Tension and fix graft proximal to the FDP

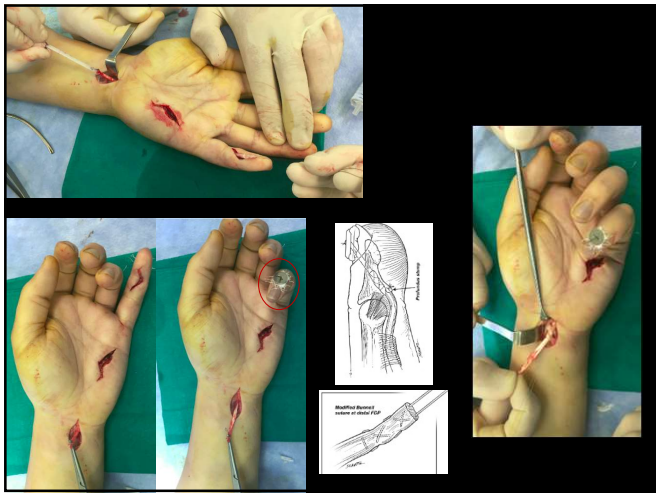


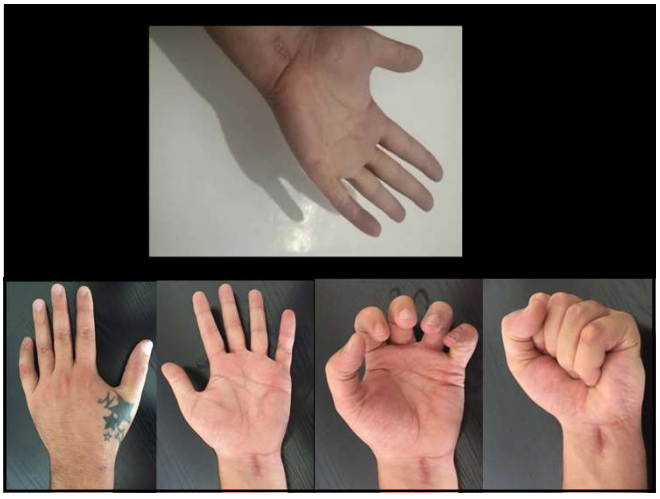












POSTOP CARE

Dorsal bloking splint 6 weeks
Early active motion protocol
No restriction at 6 months

INTACT SUPERFICIALIS

DECISION

TO AVOID PASSIVE IPEREXTENSION

DIP TENODESIS
DIP FUSION
TENDON GRAFT
STAGED GRAFT

CONCLUSIONS

RESULTS ARE HIGHLY PATIENT DEPENDANT

COOPERATION

QUALITY OF TISSUE / INTRINSIC CAPACITY TO HEAL

BIG HAND EVENT 2023
Friday, 22 September 2023

Dr Pierluigi **Tos**
Dr.ssa Matilde **Cacianti**
Dr. Vittorio **Cefalo**
Dr. Alessandro **Crosio**
Dr. Sergio **De Santis**
Dr. Mauro **Magnani**
Dr.Francesco **Locatelli**
Dr.ssa Letizia **Marenghi**
Dr.ssa Simona **Odella**
Dr.ssa Maria Grazia **Zecca**
Dr.ssa Fabiana **Zura Puntaroni**

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